

From the INTERNATIONAL BUREAU

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

United States Patent and Trademark  
Office  
(Box PCT)  
Crystal Plaza 2  
Washington, DC 20231  
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 18 March 1999 (18.03.99)	
International application No. PCT/EP98/04878	Applicant's or agent's file reference C 1991 PCT
International filing date (day/month/year) 05 August 1998 (05.08.98)	Priority date (day/month/year) 07 August 1997 (07.08.97)
<b>Applicant</b> <b>KWART, Marion et al</b>	

1. The designated Office is hereby notified of its election made:

in the demand filed with the International Preliminary Examining Authority on:

28 January 1999 (28.01.99)

in a notice effecting later election filed with the International Bureau on:

\_\_\_\_\_

2. The election  was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer  Catherine Massetti
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

# PCT

## REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference  
(if desired) (12 characters maximum) C 1991 PCT

**Box No. I TITLE OF INVENTION** Processes for increasing the yield in plants

**Box No. II APPLICANT**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (i.e. country) of residence if no State of residence is indicated below.)

This person is also inventor

Max-Planck-Gesellschaft  
zur Förderung der Wissenschaften e. V.  
Berlin  
DE

Telephone No.

Faximile No.

Telexnumber No.

State (i.e. country) of nationality:

DE

State (i.e. country) of residence:

DE

This person is applicant  
for the purposes of:

all designated  
States

all designated States except  
the United States of America

the United States  
of America only

the States indicated in  
the Supplemental Box

**Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (i.e. country) of residence if no State of residence is indicated below.)

This person is:

KWART, Marion  
Ellwanger Str. 7  
12247 Berlin  
DE

applicant only

applicant and inventor

inventor only (if this check-box  
is marked, do not fill in below.)

State (i.e. country) of nationality:

DE

State (i.e. country) of residence

DE

This person is applicant  
for the purposes of:

all designated  
States

all designated States except  
the United States of America

the United States  
of America only

the States indicated in  
the Supplemental Box

Further applicants and/or (further) inventors are indicated on a continuation sheet.

**Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**

The person identified below is hereby/has been appointed to act on behalf  
of the applicant(s) before the competent International Authorities as:

agent

common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

Telephone No.

VOSSIUS & PARTNER  
P. O. Box 86 07 67  
81634 München  
DE

+49-89-4 13 04-0

Faximile No.

Telephone No.

+49-89-4 13 04-111

Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to  
indicate a special address to which correspondence should be sent.

## Continuation of Box No. III FURTHER APPLICANTS AND/OR (FURTHER) INVENTORS

*If none of the following sub-boxes is used, this sheet is not to be included in the request.*

Name and address; (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this box is the applicant's State (i.e. country) of residence if no State of residence is indicated below.)

RESMEIER, Jörg  
Ludwigsfelder Str. 13  
14165 Berlin  
DE

This person is:

- applicant only  
 applicant and inventor  
 inventor only (If this check-box is marked, do not fill in below.)

State (i.e. country) of nationality:  
DE

State (i.e. country) of residence:  
DE

This person is applicant for the purposes of:  all designated States  all designated States except the United States of America  the United States of America only  the States indicated in the Supplemental Box

Name and address; (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this box is the applicant's State (i.e. country) of residence if no State of residence is indicated below.)

WILLMITZER, Lothar  
Arnold-Knoblauch-Ring 1  
1409 Berlin  
DE

This person is:

- applicant only  
 applicant and inventor  
 inventor only (If this check-box is marked, do not fill in below.)

State (i.e. country) of nationality:  
DE

State (i.e. country) of residence:  
DE

This person is applicant for the purposes of:  all designated States  all designated States except the United States of America  the United States of America only  the States indicated in the Supplemental Box

Name and address; (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this box is the applicant's State (i.e. country) of residence if no State of residence is indicated below.)

This person is:

- applicant only  
 applicant and inventor  
 inventor only (If this check-box is marked, do not fill in below.)

State (i.e. country) of nationality:

State (i.e. country) of residence:

This person is applicant for the purposes of:  all designated States  all designated States except the United States of America  the United States of America only  the States indicated in the Supplemental Box

Name and address; (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this box is the applicant's State (i.e. country) of residence if no State of residence is indicated below.)

This person is:

- applicant only  
 applicant and inventor  
 inventor only (If this check-box is marked, do not fill in below.)

State (i.e. country) of nationality:

State (i.e. country) of residence:

This person is applicant for the purposes of:  all designated States  all designated States except the United States of America  the United States of America only  the States indicated in the Supplemental Box

Further applicants and/or (further) inventors are indicated on another continuation sheet.

## Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

## Regional Patent

- AP ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- EA Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- EP European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- OA OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

## National Patent (if other kind of protection or treatment desired, specify on dotted line):

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> AL Albania .....                               | <input checked="" type="checkbox"/> LS Lesotho .....                                   |
| <input checked="" type="checkbox"/> AM Armenia .....                               | <input checked="" type="checkbox"/> LT Lithuania .....                                 |
| <input checked="" type="checkbox"/> AT Austria .....                               | <input checked="" type="checkbox"/> LU Luxembourg .....                                |
| <input checked="" type="checkbox"/> AU Australia .....                             | <input checked="" type="checkbox"/> LV Latvia .....                                    |
| <input checked="" type="checkbox"/> AZ Azerbaijan .....                            | <input checked="" type="checkbox"/> MD Republic of Moldova .....                       |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina .....                | <input checked="" type="checkbox"/> MG Madagascar .....                                |
| <input checked="" type="checkbox"/> BB Barbados .....                              | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia ..... |
| <input checked="" type="checkbox"/> BG Bulgaria .....                              | <input checked="" type="checkbox"/> MN Mongolia .....                                  |
| <input checked="" type="checkbox"/> BR Brazil .....                                | <input checked="" type="checkbox"/> MW Malawi .....                                    |
| <input checked="" type="checkbox"/> BY Belarus .....                               | <input checked="" type="checkbox"/> MX Mexico .....                                    |
| <input checked="" type="checkbox"/> CA Canada .....                                | <input checked="" type="checkbox"/> NZ New Zealand .....                               |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein .....  | <input checked="" type="checkbox"/> PL Poland .....                                    |
| <input checked="" type="checkbox"/> CN China .....                                 | <input checked="" type="checkbox"/> PT Portugal .....                                  |
| <input checked="" type="checkbox"/> CU Cuba .....                                  | <input checked="" type="checkbox"/> RO Romania .....                                   |
| <input checked="" type="checkbox"/> CZ Czech Republic .....                        | <input checked="" type="checkbox"/> RU Russian Federation .....                        |
| <input checked="" type="checkbox"/> DE Germany .....                               | <input checked="" type="checkbox"/> SD Sudan .....                                     |
| <input checked="" type="checkbox"/> DK Denmark .....                               | <input checked="" type="checkbox"/> SE Sweden .....                                    |
| <input checked="" type="checkbox"/> EE Estonia .....                               | <input checked="" type="checkbox"/> SG Singapore .....                                 |
| <input checked="" type="checkbox"/> ES Spain .....                                 | <input checked="" type="checkbox"/> SI Slovenia .....                                  |
| <input checked="" type="checkbox"/> FI Finland .....                               | <input checked="" type="checkbox"/> SK Slovakia .....                                  |
| <input checked="" type="checkbox"/> GB United Kingdom .....                        | <input checked="" type="checkbox"/> SL Sierra Leone .....                              |
| <input checked="" type="checkbox"/> GE Georgia .....                               | <input checked="" type="checkbox"/> TJ Tajikistan .....                                |
| <input checked="" type="checkbox"/> GH Ghana .....                                 | <input checked="" type="checkbox"/> TM Turkmenistan .....                              |
| <input checked="" type="checkbox"/> GM Gambia .....                                | <input checked="" type="checkbox"/> TR Turkey .....                                    |
| <input checked="" type="checkbox"/> GW Guinea-Bissau .....                         | <input checked="" type="checkbox"/> TT Trinidad and Tobago .....                       |
| <input checked="" type="checkbox"/> HR Croatia .....                               | <input checked="" type="checkbox"/> UA Ukraine .....                                   |
| <input checked="" type="checkbox"/> HU Hungary .....                               | <input checked="" type="checkbox"/> UG Uganda .....                                    |
| <input checked="" type="checkbox"/> ID Indonesia .....                             | <input checked="" type="checkbox"/> US United States of America .....                  |
| <input checked="" type="checkbox"/> IL Israel .....                                | <input checked="" type="checkbox"/> UZ Uzbekistan .....                                |
| <input checked="" type="checkbox"/> IS Iceland .....                               | <input checked="" type="checkbox"/> VN Viet Nam .....                                  |
| <input checked="" type="checkbox"/> JP Japan .....                                 | <input checked="" type="checkbox"/> YU Yugoslavia .....                                |
| <input checked="" type="checkbox"/> KE Kenya .....                                 | <input checked="" type="checkbox"/> ZW Zimbabwe .....                                  |
| <input checked="" type="checkbox"/> KG Kyrgyzstan .....                            |  |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea ..... |  |
| <input checked="" type="checkbox"/> KR Republic of Korea .....                     |  |
| <input checked="" type="checkbox"/> KZ Kazakhstan .....                            |  |
| <input checked="" type="checkbox"/> LC Saint Lucia .....                           |  |
| <input checked="" type="checkbox"/> LK Sri Lanka .....                             |  |
| <input checked="" type="checkbox"/> LR Liberia .....                               |  |

Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet:

- .....
- .....

**Precautionary Designation Statement:** In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.

Box No. VI PRIORITY CLAIM		Further priority claims are indicated in the Supplemental Box <input type="checkbox"/>	
The priority of the following earlier application(s) is hereby claimed:			
Country (in which or for which the application was filed)	Filing Date (day/month/year)	Application No.	Office of filing (only for regional or international applications)
Item (1) DE	(07.08.97) 7 August 1997	197 34 218.3	
Item (2)			
Item (3)			

Mark the following check-box if the certified copy of the earlier application is to be issued by the Office which for the purposes of the present international application is the receiving Office (a fee may be required):

The receiving Office is hereby requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):

#### Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen, the two-letter code may be used): ISA /

Earlier search: Fill in where a search (international, international-type or other) by the International Searching Authority has already been carried out or requested and the Authority is now requested to base the international search, to the extent possible, on the results of that earlier search. Identify such search or request either by reference to the relevant application (or the translation thereof) or by reference to the search request:

Country (or regional Office): Date (day/month/year): Number:

#### Box No. VIII CHECK LIST

This international application contains the following number of sheets:

1. request	4 sheets
2. description	22 sheets
3. claims	3 sheets
4. abstract	1 sheets
5. drawings	17 sheets
Total	47 sheets

This international application is accompanied by the item(s) marked below:

- |  |   |
|--|---|
| 1. <input type="checkbox"/> separate signed power of attorney                        | 5. <input type="checkbox"/> fee calculation sheet   |
| 2. <input type="checkbox"/> copy of general power of attorney                        | 6. <input type="checkbox"/> separate indications concerning deposited microorganisms            |
| 3. <input type="checkbox"/> statement explaining lack of signature                   | 7. <input checked="" type="checkbox"/> nucleotide and/or amino acid sequence listing (diskette) |
| 4. <input type="checkbox"/> priority document(s) identified in Box No. VI as item(s) | 8. <input type="checkbox"/> other (specify):  |

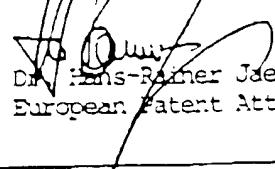
Figure No \_\_\_\_\_ of the drawings (if any) should accompany the abstract when it is published.

#### Box No. IX SIGNATURE OF APPLICANT OR AGENT

Note to each signature: indicate the name of the person signing and the capacity in which the person signs if such capacity is not obvious from reading the request.

Munich, August 6, 1998

Jae/Sz/ek

  
Dr. Hans-Rainer Jähnichen  
European Patent Attorney

For receiving Office use only

1. Date of actual receipt of the purported international application:
2. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application.
3. Date of timely receipt of the required corrections under PCT Article 11(2).
5. International Searching Authority specified by the applicant: ISA /

2. Drawings:

received:

not received

6.  Transmittal of search copy delayed until search fee is paid

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

See Notes to the request form

This sheet is not part of and does not count as a sheet of the international application.

# PCT

## FEE CALCULATION SHEET Annex to the Request

For receiving Office use only

International application No.

Date stamp of the receiving Office

Applicant's or agent's  
file reference

C 1991 PCT

Applicant

Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V. et al.

### CALCULATION OF PRESCRIBED FEES

#### 1. TRANSMITTAL FEE

DEM 200.00

T

#### 2. SEARCH FEE

DEM 2.200.00

S

International search to be carried out by EP

(If two or more International Searching Authorities are competent in relation to the international application, indicate the name of the Authority which is chosen to carry out the international search.)

#### 3. INTERNATIONAL FEE

##### Basic Fee

The international application contains 47 sheets.

17 remaining sheets x 19 additional amount

DEM 800.00

= DEM 323.00

Add amounts entered at b. and c. and enter total at D

DEM 1.123.00

D

##### Designation Fees

The international application contains all designations.

11 number of designation fees x 184.00 amount of designation fee payable (maximum 11)

DEM 2.024.00

D

Add amounts entered at B and D and enter total at E

(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are), so entitled, the total to be entered at E is 25% of the sum of the amounts entered at B and D.)

DEM 3.147.00

E

#### 4. FEE FOR PRIORITY DOCUMENT

P

#### 5. TOTAL FEES PAYABLE

Add amounts entered at T, S, I and P, and enter total in the TOTAL box

DEM 8.694.00

TOTAL

The designation fees are not paid at this time.

### MODE OF PAYMENT

authorization to charge deposit account, see below

cheque

postal money order

bank draft

cash

revenue stamps

coupons

other (specify)

### DEPOSIT ACCOUNT AUTHORIZATION (this mode of payment may not be available at all receiving Offices)

The RO: EP  is hereby authorized to charge the total fees indicated above to my deposit account.

is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.

is hereby authorized to charge the fee for preparation and transmission of the priority document to the International Bureau of WIPO to my deposit account.

2800.0321

Deposit Account Number

5 September 1998

Date (month/year)

Dr. Hans Rainer Jaenichen

Signature

European Patent Attorney JAE/Sz/e

See Notes to the fee calculation page

## PATENT COOPERATION TREATY

REC'D 10 NOV 1999

PCT

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18

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference C 1991 PCT	<b>FOR FURTHER ACTION</b>	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/EP98/04878	International filing date (day/month/year) 05/08/1998	Priority date (day/month/year) 07/08/1997
International Patent Classification (IPC) or national classification and IPC C12N15/82		
Applicant MAX-PLANCK-GESELLSCHAFT ZUR FÖRDERUNG .... et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

- I     Basis of the report
- II    Priority
- III    Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV    Lack of unity of invention
- V    Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI    Certain documents cited
- VII    Certain defects in the international application
- VIII    Certain observations on the international application

Date of submission of the demand 28/01/1999	Date of completion of this report 05.11.99
Name and mailing address of the international preliminary examining authority   European Patent Office D-80298 Munich Tel +49 89 2399 - 0 Tx 523656 epmu d Fax +49 89 2399 - 4465	Authorized officer  Bilang, J Telephone No +49 89 2399 8707
	

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/EP98/04878

**I. Basis of the report**

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

**Description, pages:**

1-22                   as originally filed

**Claims, No.:**

1-15                   as received on                   21/09/1999 with letter of                   20/09/1999

**Drawings, sheets:**

1/17-17/17           as originally filed

2. The amendments have resulted in the cancellation of:

the description,       pages:  
 the claims,           Nos.:  
 the drawings,         sheets:

3.  This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/EP98/04878

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes:	Claims 1-15
	No:	Claims
Inventive step (IS)	Yes:	Claims 1-15
	No:	Claims
Industrial applicability (IA)	Yes:	Claims 1-15
	No:	Claims

**2. Citations and explanations**

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP98/04878

**Additional remarks Item I**

In the absence of the priority document and for the purpose of the present International Preliminary Examination Report the priority is assumed to be validly claimed.

**Additional remarks Item V**

1. The present application discloses that the expression of specific proteins in companion cells leads to an increase in yield. Also claimed are the constructs comprising a sequence encoding said proteins and a sequence allowing the transcription specifically in companion cells.
2. The following documents were taken into consideration:

D1 (Lerchl, J., et al., THE PLANT CELL, vol. 7, March 1995, p. 259-270) discloses a study on the role of PP<sub>i</sub> in phloem cells. For this purpose transgenic plants were generated expressing a pyrophosphatase or an invertase or both specifically in companion cells. D1 also discloses a model on the active phloem loading (Figure 2).

D2 (Riesmeier, J.W., et al., THE EMBO JOURNAL, vol. 13, no. 1, 1994, p. 1-7) discloses the role of sucrose transporter protein in phloem loading.

D3 (Sonnewald, U., et al., NATURE BIOTECHNOLOGY, vol. 15, August 1997, p. 794-797) discloses that the expression of a yeast invertase in the apoplast of potato tubers results in increased yield (under greenhouse conditions). The invertase was expressed under the control of the tuber-specific patatin promoter.

3. It appears that the subject-matter of claims 1-15 fulfills the requirements of **Article 33 PCT**.  
None of the available documents seems to suggest that expression of sucrose synthase, invertase, etc. in companion cells indeed would lead to an increase in yield. D1, which is the only document to disclose companion cell-specific expression, is silent about the yield. Moreover, D3 suggests that invertase has to be expressed in the apoplast of tuber cells in order to increase the yield.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP98/04878

It appears that the skilled person could have made the nucleic acid molecules according to claim 9. However, the skilled person was not aware of the fact that said molecule would lead to an increase of the yield of the plants. An inventive activity therefore also can be acknowledged for the nucleic acid molecule of claim 9 due to this surprising technical effect.

## Claims

1. A process for increasing the yield of plants, characterized in that recombinant DNA molecules containing
  - (a) a region allowing the transcription specifically in the companion cells; and operatively linked thereto
  - (b) a nucleotide sequence encoding a polypeptide selected from the group consisting of:
    - (i) proteins with an enzymatic activity that cleaves sucrose;
    - (ii) sucrose transporters;
    - (iii) proteins the activity of which leads to the stimulation of the proton gradients located at the plasma membrane of plant cells; and
    - (iv) citrate synthases;and which are stably integrated into the genome of plants are expressed.
2. The process of claim 1, wherein the nucleotide sequence encodes a plant protein.
3. The process of claim 1, wherein the nucleotide sequence encodes a protein from a bacterium or a fungus.
4. The process of claim 1, wherein the nucleotide sequence encodes a protein with an enzymatic activity that cleaves sucrose, selected from the group consisting of sucrose synthases, sucrose phosphorylases and invertases.
5. The process of claim 1, wherein the nucleotide sequence encodes a sucrose transporter from *Spinacia oleracea*.
6. The process of claim 1, wherein the nucleotide sequence encodes a proton ATPase.

7. The process of claim 6, wherein the nucleotide sequence encodes a proton ATPase from Solanum tuberosum or from Saccharomyces cerevisiae.
8. The process of any one of claims 1 to 7, wherein the region mentioned in (a) is the rolC promoter from Agrobacterium rhizogenes.
9. A recombinant nucleic acid molecule containing
  - (a) a region allowing the transcription specifically in the companion cells of plants; and operatively linked thereto
  - (b) a nucleotide sequence encoding a polypeptide, selected from the group consisting of
    - (i) sucrose synthases;
    - (ii) sucrose phosphorylases;
    - (iii) sucrose transporters;
    - (iv) proteins the activity of which leads to the stimulation of the proton gradient located at the plasma membrane of plant cells; and
    - (v) citrate synthases,wherein said recombinant nucleic acid molecule, when stably integrated into the genome of plants and expressed, leads to an increase of the yields of plants.
10. A vector containing a recombinant nucleic acid molecule of claim 9.
11. The vector of claim 10 which is suitable for the transformation of plant cells and for integration of foreign DNA into the plant genome.
12. A plant cell transformed with and containing a recombinant nucleic acid molecule of claim 9.
13. A plant containing plant cells of claim 12, wherein the plant shows an increased yield in comparison to a corresponding non-transformed plant due to the expression of the recombinant nucleic acid molecule in the companion cells of the plant.

14. Propagation material of a plant of claim 13, wherein said propagation material contains plant cells of claim 12.
15. Use of a recombinant nucleic acid molecule containing a region allowing the transcription specifically in the companion cells of plants and operatively linked thereto a nucleotide sequence encoding a polypeptide selected from the group consisting of
  - (i) proteins with an enzymatic activity that cleaves sucrose;
  - (ii) sucrose transporters;
  - (iii) proteins the activity of which leads to the stimulation of the proton gradient located at the plasma membrane; and
  - (iv) citrate synthases,for the expression in transgenic plants for increasing the yield.

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>C 1991 PCT</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/EP 98/ 04878</b>	International filing date (day/month/year) <b>05/08/1998</b>	(Earliest) Priority Date (day/month/year) <b>07/08/1997</b>
Applicant <b>MAX-PLANCK-GESELLSCHAFT ZUR FÖRDERUNG .... et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 4 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

1.  Certain claims were found unsearchable (see Box I).
2.  Unity of invention is lacking (see Box II).
3.  The international application contains disclosure of a nucleotide and/or amino acid sequence listing and the international search was carried out on the basis of the sequence listing
  - filed with the international application.
  - furnished by the applicant separately from the international application.
  - but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
  - Transcribed by this Authority
4. With regard to the title,
  - the text is approved as submitted by the applicant
  - the text has been established by this Authority to read as follows:
5. With regard to the abstract,
  - the text is approved as submitted by the applicant
  - the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this International Search Report, submit comments to this Authority.
6. The figure of the drawings to be published with the abstract is:
 

Figure No. 14

  - as suggested by the applicant.
  - because the applicant failed to suggest a figure.
  - because this figure better characterizes the invention.
  - None of the figures.

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 98/04878

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 C12N15/82	C12N9/10	C12N9/24	C12N9/88	C12N9/14
C12N15/54	C12N15/55	C12N15/60	C12N5/10	A01H5/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 C12N A01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>LERCHL, J., ET AL. : "IMPAIRED PHOTOASSIMILATE PARTITIONING CAUSED BY PHLOEM-SPECIFIC REMOVAL OF PYROPHOSPHATE CAN BE COMPLEMENTED BY A PHLOEM-SPECIFIC CYTOSOLIC YEAST-DERIVED INVERTASE IN TRANSGENIC PLANTS" THE PLANT CELL, vol. 7, March 1995, pages 259-270, XP002086882 especially page 259; Fig. 2 + 3 see the whole document</p> <p>---</p> <p style="text-align: center;">-/--</p>	1,3,4,8, 15

 Further documents are listed in the continuation of box C Patent family members are listed in annex

## Special categories of cited documents:

- 'A' document defining the general state of the art which is not considered to be of particular relevance
- 'E' earlier document but published on or after the international filing date
- 'L' document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- 'O' document referring to an oral disclosure, use, exhibition or other means
- 'P' document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- &" document member of the same patent family

Date of the actual completion of the international search

7 December 1998

Date of mailing of the international search report

21/12/1998

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Holtorf, S

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 98/04878

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication where appropriate of the relevant passages	Relevant to claim No
A	ZRENNER, R., ET AL. : "evidence of the crucial role of Sucrose synthase for sink strength using transgenic potato plants ( <i>Solanum tuberosum L.</i> )" THE PLANT JOURNAL, vol. 7, no. 1, 1995, pages 97-107, XP002086883 page 104, right column; Fig. 9 ---	1-15
A	RIESMEIER, J.W., ET AL. : "evidence for an essential role of the sucrose transpoter in phloem loading and assimilate partitioning" THE EMBO JOURNAL, vol. 13, no. 1, 1994, pages 1-7, XP002086884 abstract, Fig. 2; Table 1; pages 5,6; page 6, last sentence ---	1-15
A	FOYER C H ET AL: "MODIFICATIONS IN CARBON ASSIMILATION, CARBON PARTITIONING AND TOTAL BIOMASS AS A RESULT OF OVER-EXPRESSION OF SUCROSE PHOSPHATES SYNTHASE IN TRANSGENIC TOMATO PLANTS" PLANT PHYSIOLOGY, vol. 105, no. 1, 1 May 1994, page 23 XP002002230 see the whole document ---	1-15
A	MARTIN T ET AL: "EXPRESSION OF AN ARABIDOPSIS SUCROSE SYNTHASE GENE INDICATES A ROLE IN METABOLIZATION OF SUCROSE BOTH DURING PHLOEM LOADING AND IN SINKORGANS" PLANT JOURNAL, vol. 4, no. 2, 1993, pages 367-377, XP002061421 abstract, page 307, right column; page 368, left column; page 371,373,375: Fig. 7 ---	1-15
A	SONNEWALD. U., ET AL. : "increased potato tuber size resulting from apoplastic expression of a yeast invertase" NATURE BIOTECHNOLOGY, vol. 15, August 1997, pages 794-797. XP002086885 see the whole document ---	1-15

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## INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 98/04878

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication where appropriate, of the relevant passages	Relevant to claim No
A	RIESMEIER, J.W., ET AL. : "potato sucrose transporter expression in minor veins indicates a role in phloem loading" THE PLANT CELL, vol. 5, November 1993, pages 1591-1598, XP002086886 see the whole document -----	1-15